

The Editor

Subject: Answers to the reviewer's comments

Dear Editor,

I would like to submit the revised manuscript (ID-412). Revisions are marked in red in the text. We have addressed the following reviewer comments, and the replies to the comments are listed below:

Reviewer Comments #1:1.

The device discussed in your paper is usually called "Frequency-selective surface". It has been used extensively in the last 60 years in various multiband satellite antennas, much before the buzzwords "metamaterial" and "metasurface" were invented. Sometimes it is also called a "Dichroic mirror"?

Answer: Thank you for the comment. Based on the reviewer's comment, frequency selective surface (FSS) structures with multi pole characteristics have been widely investigated in the microwave and millimeter-wave frequencies of the spectrum. It has been used extensively in the last few decades in various applications. Currently, frequency selective surfaces based on metamaterials are increasingly important in microwave technique. Moreover, metamaterials are artificial material, which are composed of periodic metals on dielectric substate that exhibiting properties which are not found in the nature; such as, negative refractive index, negative permeability, left handed characteristics, etc. In the manuscript, the effective permittivity, permeability and refractive index curves show real magnitude of negative values from 6.35 to 7.72 GHz. According to the left handed metamaterial characteristics, when the permittivity and permeability are simultaneously negative, then the refractive index is negative. Therefore, the designed metamaterial is called as a left handed metamaterial for any frequency points in the microwave frequency range from 6.35 to 7.72 GHz. Such as, at 6.43 GHz the real magnitude of the effective permittivity, permeability and refractive index are respectively, -68.27, -42.01, and -54.67. However, from the above explanation it can be said that the proposed design also shows left handed metamaterial characteristics with the frequency selective surface characteristics. As a result, the authors make the correction by replacing the meat-surface through the frequency selective surface characteristics metamaterial in the title of the revised manuscript. All the necessary information's are are marked in yellow in the revised manuscript.

Reviewer Comments #1: 2.

Your theoretical explanation includes several reactive LC components while your simulation and measurement both show one single resonance?

Answer: Thank you for the comment. The authors have been established the equations (12-13), to theoretically and electrically validation by the equivalent LC components circuit of the proposed design through calculating the resonance frequency. In addition, from the developed equations the resonance frequency is around at 5.1 GHz, whereas the simulated resonance is at 5.26 GHz and the measured

resonance is around at 5.17 GHz have been shown in figure 4. Besides, the effect on the resonance frequency through various types of dielectric materials by using as a substrate material for the proposed FSS metamaterial also explained in detail with the figure 6(a-b) and table 2 in the revised manuscript, which are marked in yellow.

Reviewer Comments #1: 3.

Your device probably exhibits some polarization dependence. Likely it only works for a selected linear polarization. This is not described anywhere in your paper.

Answer: Thank you for the comment. Based on the reviewer's suggestion, the authors have been discussed about the lineary polarization dependency of the proposed devices in the revised manuscript, which are marked in yellow.

Reviewer Comments #1: 4.

You reference list is not citing any relevant articles to the above topics. If you claim a new scientific achievement, then you have to show that your new device performs better than any well known, existing and commercially available designs?

Answer: Thank you for the suggesstion. Based on the reviewer's suggesstion, the authors have been cited the relvent articles on the proposed metamaterial with a detail comparison table 3 of the well performed existing and commercially available designs in the revised manuscript, which is marked in yellow.

Sincerely yours

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